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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/565,653	01/24/2006	Koichi Kanaya	126247	6147
25944	7590	10/02/2007	EXAMINER	
OLIFF & BERRIDGE, PLC			CHEN, KEATH T	
P.O. BOX 19928			ART UNIT	PAPER NUMBER
ALEXANDRIA, VA 22320			1762	
			MAIL DATE	DELIVERY MODE
			10/02/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/565,653

Applicant(s)

KANAYA ET AL.

Examiner

Keath T. Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 September 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5-19 is/are pending in the application.
- 4a) Of the above claim(s) 17-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

The claim amendment filed on 09/04/2007, addressing claim 5-12 rejections from the first office action (05/02/2007), is acknowledged and will be addressed below.

1. Newly submitted claims 17-19 (group II) are directed to an invention that is independent or distinct from the invention originally claimed (claims 5-16, group I) for the following reasons: Lack of unity of invention. The common features of these two groups are heating while substrate on susceptor, pocket, and U-shaped susceptor (the forming process is not part of the apparatus claim, see claim interpretation below). This set of common feature lack specialty (for example, by JP 2000355766 and US 5088697 discussed below). Group II (method of forming susceptor) was not in the original presentation.

Since applicant has received an action on the merits for the originally presented invention, this invention (group I) has been constructively elected by original presentation for prosecution on the merits. Accordingly, group II, claims 17-19, are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim interpretation

Amended claim 5, lines 9-11, "the susceptor is formed by heat-treating a body section composed of graphite and then coating a surface of the body section with SiC, and is formed to have a warped inverted U-shaped longitudinal sectional shape during the heat-treating" is a product by process claim.

When the reference teaches a product that appears to be the same as, or an obvious variant of, the product set forth in a product-by-process claim although produced by a different process. See *In re Marosi*, 710 F.2d 799, 218 USPQ 289 (Fed. Cir. 1983) and *In re Thorpe*, 777 F.2d 695, 227 USPQ 964 (Fed. Cir. 1985). See also MPEP §2113.

Therefore, the process of making the warped susceptor has no patentable weight. Claim 5 does require the susceptor being composed of graphite and a surface of the body section with SiC.

Likewise, amended claim 13, "a depth of the pocket has been reduced by a warp amount during the heat-treatment warping ..." is a product by process claim. The process of warping the susceptor has no patentable weight.

Response to Arguments

2. Applicant's arguments on the 102(b) rejection of claim 5 based on by Van Bilsen et al. (US 6,284,048, hereafter '048) have been fully considered but they are not persuasive.

Applicant's arguments based on that the warped inverted U-shaped longitudinal sectional shape is at the far end of the susceptor. However, claim 5 states "the susceptor ... have a warped inverted U-shaped longitudinal sectional shape". There is not limitation stating that the warped inverted U-shaped longitudinal sectional shape has to be in the center of the susceptor.

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Applicant further stated that '048 "fails to appreciate the problem overcome by the invention" is not persuasive. "A reference may be directed to an entirely different problem than the one addressed by the inventor", MPEP 2131.05, lines 8-9.

3. Applicant's arguments on the 102(b) rejection of claim 5 based on by Kokusai (JP 2000355766 English Translation of detailed description, hereafter '766) have been fully considered but they are not persuasive.

Applicant's arguments based on that the inverted U-shaped in Fig. 2 is by Zagury process, not by heat treatment. As stated above (MPEP 2113), the product by process claim is limited by its structure and the susceptor #17 having crevices #31 and #32 does meet the limitations of claim 5.

Applicant further state that "susceptor remains flat" (last line on page 7, referring to '766) without pointing out the basis of this statement. The examiner cannot find support in '766 to support this statement and based on the fact that the crevices #31 and #32 makes susceptor non-flat, the above argument is found not persuasive.

Applicant did not address the claim rejections of claims 9 to 12.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 5 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Bilsen et al. (US 6,284,048, hereafter '048), further in view of Moore et al. (US 5444217, hereafter '217).

'048 teaches some limitations of claim 5:

A vapor phase growth apparatus (Fig. 1, #10) comprising a susceptor (#20) for performing a vapor phase growth of a silicon epitaxial layer (abstract) on a main surface (the top of #16 is a main surface) of a silicon single crystal substrate while heating the silicon single crystal substrate (Fig. 1, #16, epitaxial growth has to be on single crystal) from both sides (Fig. 1, #13 and #14 are heaters from both sides) while it is on a pocket (Fig. 2, between #56 and #16) formed on the susceptor (#20), wherein the pocket has an outer peripheral side part (Fig. 2, #66) which supports a rear surface of a silicon single crystal substrate and an inner peripheral side part (Fig. 2, between #56 and #16) which is kept in a state of being more recessed than the outer peripheral side part in an inside of the outer peripheral side part, and the susceptor is a body section composed of graphite (col. 6, lines 59-61, the materials utilized in the past including graphite, col.

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2, line 9-12), is formed to have a warped inverted U-shaped longitudinal sectional shape (Fig. 2, #62 is U-shaped, col.7, paragraph 3).

'048 also teaches the use of SiC as susceptor material for high temperature cycling (col. 6, lines 61-67).

'048 does not explicitly teach the other limitation of claim 5:

Coating a surface of the body section with SiC.

'217 is an analogous art in the field of RTP (a CVD) for semiconductor processing of large wafer (field of the invention, '048, col. 2, lines 16-27 and col. 3, lines 5-7), particularly in reducing contamination (col. 6, lines 42-44, '048, cl. 6, line 67 to col. 7, line 3). '217 teaches graphite susceptor coated with thin SiC to prevent contamination (col. 40, lines 24-28).

At the time of the invention was made, it would have been obvious to a person of ordinary skill in the art to have coated thin SiC, as taught in '217) on the graphite susceptor (#20) of the apparatus in Fig. 2 of '048, for the purpose of preventing contamination, with a reasonable expectation of success.

'048 also teaches all the limitations of claim 13:

A depth of the pocket has been reduced (by its forming process relative to the full height of #52) by a warp amount of the inverted U-shaped longitudinal sectional shape.

5. Claims 6 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over '048 and '217, further in view of Yao et al. (US 2002/0066412, hereafter '412).

'048 and '217, together, teach all limitations of claim 5, as discussed above. '048 further teaches the distance between a bottom surface of the inner peripheral side part

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in the pocket and a rear surface of the silicon single crystal substrate (or the gap) for 200 mm wafers (col. 7, line 41-48) can be between 0.005 and 0.080 inch (between 0.127 mm and 2.03 mm). '048 further recognizes application for 300 mm wafer (col. 8, lines 1-3).

'048 does not explicitly teaches:

The pocket is formed for a silicon single crystal substrate having a diameter of 300 mm or more, and when a silicon single crystal substrate is placed on and supported by the outer peripheral side part of the susceptor, a maximum distance between a bottom surface of the inner peripheral side part in the pocket and a rear surface of the silicon single crystal substrate is less than 0.4 mm

'412 is an analogous art in the field of chemical vapor deposition, specifically for processing a semiconductor substrate that minimizes contact with the backside of the substrate. '412 provides the gap depth at a range of 0.15 to 0.5 mm for 300 mm wafers (bottom of [0029]), preferably at 0.25 mm. This distance is between the backside surface of the wafer and the bottom recessed surface #46, therefore, it is measured when the substrate is placed on and supported by the outer peripheral side part of the susceptor.

At the time of the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted the range provided by '412 and incorporated a 0.25 mm gap depth to be the pocket depth in Fig. 2 of '048 (same as the thickness of the lips #66), in a susceptor for 300 mm wafers, with a reasonable expectation of success and the expectation of similar results. The selection of a known material based

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on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (MPEP 2144.07).

For substantially the same reason as claim 13 and claim 6 rejections above, claim 14 is rejected.

6. Claims 9 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over '048 and '217, further in view of Dutartre et al. (US 6162706, hereafter '706).

'048 and '217, together, teach all the limitations of claims 5, as discussed above.

'048 and '217, together, do not teach the limitation of claim 9:

A vapor phase growth method, comprising performing a vapor phase growth of a silicon epitaxial layer on a main surface of a silicon single crystal substrate using the vapor phase growth apparatus as claimed in claim 5.

'706 is an analogous art in the vapor phase epitaxial deposition of silicon on a silicon substrate. '706 teaches a vapor phase growth method, comprising performing a vapor phase growth of a silicon epitaxial layer on a main surface of a silicon single crystal substrate (abstract).

At the time of the invention was made, it would have been obvious to one having ordinary skill in the art to have known that the method performed in '706 is capable of being performed by the apparatus as taught by '408 and '217, given the fact that '706 is a vapor phase method of forming an epitaxial layer of Si on top of a single crystal Si substrate and a suitable apparatus for performing said step would be the device as

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taught in '408. The motivation would have been to achieve a reduced temperature ramp time by using a lower mass susceptor.

For substantially the same reason as claim 13 and claim 9 rejections above, claim 15 is rejected.

7. Claims 10 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over '048, '217 and '412 as applied to claim 6 above, and further in view of '706, for the same reasons given regarding claim 9 above.

8. Claims 5, 7 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kokusai (JP 2000355766 English Translation of detailed description, hereafter '766), further in view of Murakami (US 5088697, hereafter '697).

'766 teaches some limitations of claim 5:

A vapor phase growth apparatus (Fig. 3) comprising a susceptor (Fig. 2, #17, the second susceptor) for performing a vapor phase growth of a silicon ('766 translation, [0005]) epitaxial layer ([0001]) on a main surface (Fig. 3, #5, the top of #5 is a main surface) of a silicon single crystal substrate while heating the silicon single crystal substrate (Fig. 1, #16, epitaxial growth has to be on single crystal) from both sides (Fig. 3, heating from left and right sides of each wafer #5) while it is on a pocket (#31) formed on the susceptor (#17), wherein the pocket has an outer peripheral side part (Fig. 2, the outside of #31 which is near the substrate #5) which supports a rear surface of a silicon single crystal substrate and an inner peripheral side part (Fig. 2, the inside of #31) which is kept in a state of being more recessed than the outer peripheral side part in an inside of the outer peripheral side part, and the susceptor is formed a body section

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composed of carbon and then coating a surface of the body section with SiC ([0013], line 4, SiC coat carbon), and is formed to have a warped inverted U-shaped longitudinal sectional shape (Fig. 2, #32, [0015]).

'766 does not explicitly teaches the other limitation of claim 5:

The susceptor is formed a body section composed of graphite.

'697 is an analogous art in the field of CVD (abstract), particularly in eliminating the bad effect on the exposed portion of the susceptor (col. 2, lines 27-31). '697 teaches that graphite is normally used for susceptor because its workability (col. 3, lines 36-38).

At the time of the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted graphite as susceptor material as taught by '697 in the apparatus of Fig. 2 of '766, for the purpose of workability, with a reasonable expectation of success and the expectation of similar results. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (MPEP 2144.07).

'766 further teaches the limitations of claim 7:

The susceptor is a type of a single wafer (Fig. 2, each secondary susceptor #17 holds one wafer #5), and a curvature on a rear surface side of the susceptor is $1.75 \times 10^{-5} \text{ mm}^{-1}$ or less.

Based on the information in Table 1 of '766, an 8 inch wafer with an 85 μm depth crevice is equivalent to a curvature of $1.7 \times 10^{-5} \text{ mm}^{-1}$, therefore, '766 taught the limitations of claim 7.

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'766 also teaches all the limitations of claim 13:

A depth of the pocket has been reduced (by the milling process) by a warp amount of the inverted U-shaped longitudinal sectional shape.

9. Claims 6, 8, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over '766 and '697, in view of '412.

'766 and '697, together, teach all limitations of claim 5 and 7, as discussed above. '766 further teaches the distance between a bottom surface of the inner peripheral side part in the pocket and a rear surface of the silicon single crystal substrate (or the gap) for 200 mm wafers. Although '766 indicates the depth of the gap increases as wafer size increases, the gap depth is well below 0.4 mm (Table 1).

'766 and '697, together, do not explicitly teaches the limitations of claim 6:

The pocket is formed for a silicon single crystal substrate having a diameter of 300 mm or more, and when a silicon single crystal substrate is placed on and supported by the outer peripheral side part of the susceptor, a maximum distance between a bottom surface of the inner peripheral side part in the pocket and a rear surface of the silicon single crystal substrate is less than 0.4 mm

'412 is an analogous art in the field of chemical vapor deposition, specifically for processing a semiconductor substrate that minimizes contact with the backside of the substrate. '412 provides the gap depth at a range of 0.15 to 0.5 mm for 300 mm wafers (bottom of [0029]), preferably at 0.25 mm.

At the time of the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted the range provided by '412 and incorporated a

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0.25 mm gap depth to the pocket #31 in Fig. 2 of '766, in a susceptor for 300 mm wafers, with a reasonable expectation of success and the expectation of similar results. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (MPEP 2144.07).

For substantially the same reason as claim 13 and claim 6 rejections (based on '766) above, claim 14 is rejected.

10. Claims 9, 11, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over '766 and '697, as applied to claims 5, 7, and 13 above (numerate list item 8), and further in view of '706, for the same reasons given regarding claims 9 and 15 above (numerate list item 8, based on '048).

11. Claims 10, 12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over '766, '697, and '412 as applied to claims 6, 8, and 14 above (numerate list item 9), and further in view of '706, for the same reasons given regarding claim 9 and 15 above (numerate list item 6, based on '048).

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keath T. Chen whose telephone number is 571-270-1870. The examiner can normally be reached on M-F, 8:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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MICHAEL B. CLEVELAND
SUPERVISORY PATENT EXAMINER